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## Can Paper Mulberry Contribute to Building Sustainable Rural Livelihoods in Northern Laos?

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### Abstract

Most ethnic minority villages in northern Lao PDR continue to rely on non-timber forest products (NTFPs) for much of their subsistence and cash economy. Paper mulberry (*Broussonetia papyrifera*) is an important NTFP in many parts of northern Laos, providing opportunities for earning cash income, particularly for women. Since the plant has been successfully domesticated by local people, it has also been widely proposed as the basis for a sustainable agroforestry system. The major objectives of this article are to investigate the production, processing and marketing system of paper mulberry and to assess its potential to contribute to building sustainable rural livelihoods in northern Lao PDR. We also elucidate how this perennial plant has been affected by recent government policies, changes in resource management — from gathering to domestication — and current land use transitions, drawing on a case study from Pha Oudom district, Bokeo province, northern Laos. Whether a sustainable production and supply-chain management system for paper mulberry can be developed that provides a reliable — albeit modest — source of income for many ethnic minority villagers in northern Laos will largely depend on the capacity of local producers to enhance product quality and to become more active and equal actors in the value chain, but most of all on the political will of the Lao government to rethink its controversial agriculture and forest policies that aim at reducing agricultural diversity and restrict access to NTFPs through resettlement of formerly forest-dependent communities.

**Keywords:** paper mulberry, non-timber forest products, agroforestry systems, rural livelihoods, northern Lao PDR

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## I Introduction

Forests play a central role in the livelihoods of ethnic minorities in northern Laos. Non-timber forest products (NTFPs) in particular are crucial resources for both the subsistence economy and for cash income [Yokoyama 2004; Rigg 2006; Akimichi 2009]. Based on studies of the Asian Development Bank (ADB) and the United Nations Development Program (UNDP), Rigg [2005] reports that between 60 and 75% of poor villages in Laos depend on the forest for most of their non-rice subsistence needs and for at least half of their cash income.

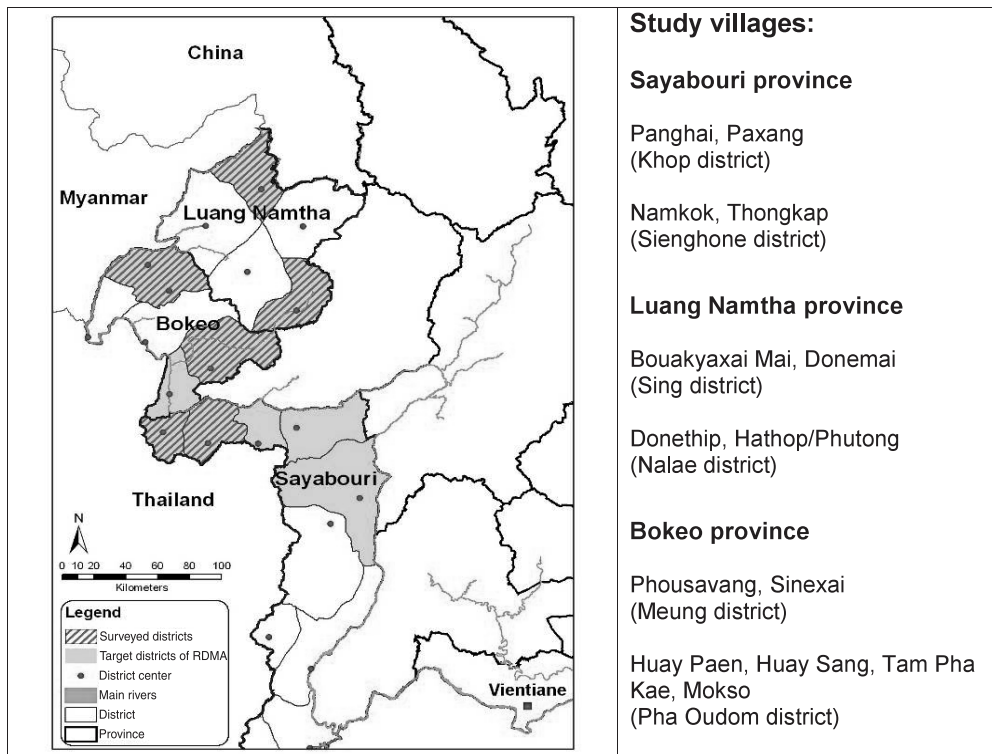
Paper mulberry (*Broussonetia papyrifera*) is an important non-timber forest product (NTFP) in northern Laos, providing opportunities for earning cash income, particularly during the dry season, where the collection of the bark does not compete with other activities. Mulberry paper is durable and can be further processed into various high-value products. In Chiang Mai, Thailand and in Luang Prabang, Laos, paper mulberry is manufactured into a wide variety of products for the booming tourist industry. Paper mulberry is also considered for its potential to improve upland rice-based fallow systems because of its rapid growth, its relative resilience to fire and its capacity to suppress weeds and improve soil fertility [Watanabe *et al.* 2004; Sakurai *et al.* 2005]. Studies suggest that nutrients in deeper layers of the soil are absorbed by the trees and then returned to the soil in form of organic matter by the tree's biomass, which can benefit other cash crops and rice production [Forsen *et al.* 2001].

The objective of this paper is to investigate production systems, processing activities and the degree of commercialization of paper mulberry and to determine how this crop affects rural people's livelihoods and resource management. The paper also aims at eliciting the impact of current government policies on the future contribution of NTFPs to rural development.

## II Study Sites and Methodology

The overview of the contribution of NTFP-based value chains to household cash revenues and livelihoods in three northern provinces of Lao PDR (Section III) is based on information gathered during a brief consultancy conducted in February/March 2008 for the Institute of Project Planning (IP-Consult), Stuttgart, which has been implementing project components of a large-scale Lao-German rural development project (Rural Development in Mountainous Areas of Northern Lao PDR – RDMA) instigated by the German Agency of Technical Cooperation (GTZ) in the provinces of Bokeo, Luang Namtha and Sayabouri (Fig. 1).

The study villages were chosen after discussions with the local agricultural or



**Fig. 1** Map of Surveyed Provinces, Districts and Study Villages  
Source: Map by Peter Elstner

natural resource management advisors of RDMA. In all 12 selected study villages, group interviews with the village headman and members of the village committee were conducted. Interested villagers were also invited to join. Participation in the group meetings ranged from 3–20 persons, with an average of 6–8 participants. Additional information was gained from unstructured interviews with NTFP traders in Sienghone district and from a local manager of NTFP nurseries in Pha Oudom district. Direct observation was applied in the case of NTFP processing and trading. Relevant project documents, monitoring data and journal articles were collected and reviewed as secondary information.

The in-depth analysis of the paper mulberry value chain (Chapter IV) was done in three villages of Pha Oudom district, Bokeo province, during an interdisciplinary study project conducted from March–May 2007 and coordinated by Dr. Andreas Neef and Dr. Pornsiri Suebpongsang. Primary data were obtained from field surveys, observations during harvesting and structured interviews with 45 farm households of three different ethnic minority groups (Lamet, Khmu, Hmong) and three Lao traders in Pha Oudom district, Bokeo province, northern Laos, and a Thai processor in Sankampaeng district, Chiang Mai province, North Thailand. Additional secondary information was used to

analyze the marketing system.

### III Contribution of NTFP-based Value Chains to Rural Livelihoods in Three Northern Provinces of Lao PDR

The purpose of this section is to present recent trends in the contribution of non-timber forest products (NTFPs) and their value chains to household income and rural livelihoods, with a major focus on plant-based NTFPs.

#### III. 1 *Naturally Occurring NTFPs and Contributions to the Rural Cash Economy*

Naturally occurring NTFPs have long been an important supplement for rural people's diet in northern Lao PDR. Due to enhanced accessibility of villages and rising demand in neighbouring countries, particularly Thailand and China, they have also become a major source of cash revenues (Table 1).

The figures presented in Table 1 are only rough estimates by members of the village committees during the group interviews based on data of the entire village. Thus, they only present the average contribution of NTFPs to household cash revenues and do not consider labour costs and other input costs (this also applies to the figures and calculations in Chapter IV). Due to difficulties in estimating cash revenues from livestock and hunting, only the "plant-based" household cash revenues were calculated. Yet, the figures show a clear trend: in those areas that have been only recently connected to markets for NTFPs and where farmers are primarily subsistence-oriented, the average contribution of plant-based NTFPs is still relatively high, particularly in Nalae and Meung, two districts that have remained fairly isolated until 2005. In more market-oriented districts, such as Khop district in Sayabouri, bordering Thailand with good market opportunities for Job's Tears, maize and sesame, the contribution of NTFPs to plant-derived household cash revenues has already declined to less than 15% on average. In Khop district, the diversity of commercial NTFPs is also diminished. The lowest economic importance of NTFPs can be witnessed in Sing district, Luang Namtha province, mainly as a result of rubber expansion into former forestland and swidden cultivation areas.

**Table 1** Main Plant-based NTFPs and their Contribution to Household Cash Revenues

| Districts            | Main Commercial Plant-derived NTFPs       | Average Contribution to Plant-based HH Cash Revenues in Percent <sup>1)</sup> |
|----------------------|---|---|
| Nalae (Luang Namtha) | Sugar palm, incense bark, mushrooms       | 20–50   |
| Meung (Bokeo)        | Sugar palm, rattan shoots, incense bark   | 15–20   |
| Pha Oudom (Bokeo)    | Paper mulberry, incense bark, sugar palm  | 15–20   |
| Khop (Sayabouri)     | Paper mulberry, incense bark, broom grass | 5–15  |
| Sing (Luang Namtha)  | Broom grass                               | < 5   |

Note: <sup>1)</sup> Village committees' estimate; main author's survey 2008

### III. 2 *Current Pressure on NTFPs Due to Government Policies*

The government of Lao PDR is getting increasingly serious in its fight against swidden cultivation, with the target of eliminating this practice — deemed unsustainable by agricultural and forest officials — by the year 2010. Relocation of villages from upland forest areas — causing a doubling of the population in some lowland and midland regions — and various types of ‘encouragement’ to establish commercial tree plantations have considerably reduced fallow periods within only a few years, a process that has taken several decades in neighbouring countries, such as Thailand and Vietnam, where swidden cultivation also has been branded as a backward and unsustainable practice by policy makers and extension workers who tend to ignore scientific evidence in favour of swidden agriculture in certain environments. A number of recent studies have found that some types of swidden cultivation, such as rotational swiddening and composite swidden systems can be fairly sustainable practices, even under rising population pressure [cf. Rigg 2005; Tran Duc Vien *et al.* 2009].

Closely related to the shortening of fallow periods in swidden fields is the reduced availability or complete disappearance of a range of NTFPs that can only develop after a sufficiently long fallow period. Table 2 shows some of the problems related to NTFP availability that villagers in the 12 study villages reported in the group meetings. The trend towards shorter fallow periods induced by government policies and rising popula-

**Table 2** Shortening of Fallow Periods and Related Problems for NTFP Availability in the Surveyed Districts

| District              | Fallow Length | Reported Problems  |
|-----------------------|---------------|--|
| Nalae (Luang Namtha)  | 4–6 years     | Sugar palms have disappeared from swidden fields, villagers have difficulties in protecting their NTFPs against outsiders            |
| Pha Oudom (Bokeo)     | 3–4 years     | Cardamom can only be found in protection forest, paper mulberry and <i>peuak meuak</i> (for incense bark) need to be planted         |
| Meung (Bokeo)         | 3 years       | No time for rattan to reach maturity, the occurrence of sugar palms is drastically diminished  |
| Sienghone (Sayabouri) | 2–3 years     | Rattan shoots are sold (at lower prices) instead of the more profitable rattan canes, sugar palms have disappeared                   |
| Khop (Sayabouri)      | 1–3 years     | No sugar palms in the entire area since 1999, <i>bong</i> bark disappeared in 2007, paper mulberry mostly harvested from plantations |
| Sing (Luang Namtha)   | 0–1 year      | Broom grass remains the only naturally occurring NTFP with some commercial value, bamboo shoots need to be planted                   |

Source: Main author's survey 2008

Note: Sample of two villages per district; information based on statements made in group meetings

tion pressure significantly reduces the diversity of NTFPs. Fig. 2 depicts the close link between swidden fallow periods and the availability of selected NTFPs. While the relatively low-value NTFPs, such as broom grass and paper mulberry, can thrive in short fallow systems, high-value NTFPs like cardamom, rattan and sugar palm need much longer fallow periods to reach maturity.

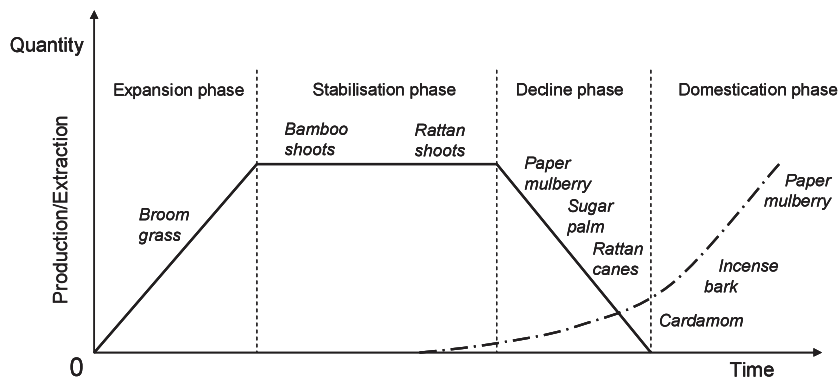
The current dynamics of extraction and cultivation of naturally occurring NTFPs are visualized in Fig. 3. While broom grass is in a rapid expansion phase, the extraction of bamboo and rattan shoots appears to be relatively stable, while natural stands of paper mulberry and sugar palm and — in particular — rattan canes are currently on the decline

| NTFP           |   |   | Age of swidden fallow |   |   |   |   |   |   |    |    |
|----------------|---|---|-----------------------|---|---|---|---|---|---|----|----|
|                | 1 | 2 | 3                     | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| Broom grass    | ◆ | ◆ | ◆                     | ◆ |   |   |   |   |   |    |    |
| Paper mulberry | ◆ | ◆ | ◆                     | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆  | ◆  |
| Incense bark   |   | ◆ | ◆                     | ◆ | ◆ | ◆ | ◆ | ◆ | ◆ | ◆  | ◆  |
| Cardamom       |   |   |                       |   | ◆ | ◆ | ◆ | ◆ | ◆ | ◆  | ◆  |
| Sugar palm     |   |   |                       |   |   |   |   | ◆ | ◆ | ◆  | ◆  |

**Fig. 2** Link between Swidden Fallow Periods, Major Driving Forces and Availability of NTFPs

Source: Based on Yokoyama [2004] and main author's survey 2008

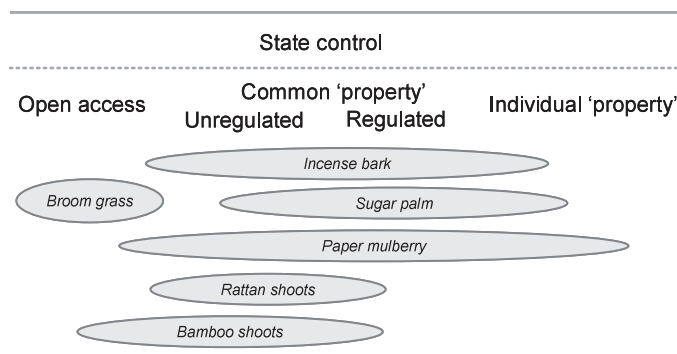
Note: Quantity gathered: small ◆, moderate ◆



**Fig. 3** The Dynamics of Extraction and Cultivation of Major NTFPs in the Three Target Provinces

Source: Draft based on Homma [1995] and Ribeiro and Darnhofer [2007]; main author's survey 2008

Note: The curves depict trends for individual NTFPs only.



**Fig. 4** Types of Access and Tenure Regimes for NTFPs in the Target Provinces

Source: Main author's survey 2008

Note: 'Unregulated property' refers to communally managed resources without established rules and regulations regarding extraction; 'regulated property' refers to resources whose extraction is subject to rules and regulations devised by a communal authority and generally accepted by community members.

due to over-exploitation. Cardamom could either be about to disappear in most areas and/or on the brink of a slow domestication process in other regions, while incense bark and particularly paper mulberry have already been successfully domesticated in Pha Oudom, Bokeo province and in most parts of Sayabouri province.

In this dynamic environment, the types of access and tenure regimes for NTFPs are also quickly adapting to new realities (Fig. 4). While until recently natural stands of paper mulberry used to be considered as an unregulated common property by many ethnic groups [cf. Yokoyama 2004], its extraction has now become more regulated in several locations. In some villages, such as Panghai in Khop district, Sayabouri, paper mulberry stands are regarded as individual property within the production forest in which each family knows the boundaries, since the area had been used for swidden cultivation of upland rice prior to the land use planning process.

The extraction of sugar palm seeds is also regulated: mobile traders would arrange an appointment a few days in advance with the village headman, who then announces to all villagers that they can start to harvest palm seeds. During this very short period, villagers are allowed to extract as much as they can find on a 'first-come, first-served' basis. Only in a Black Lahu village in Meung district, the village committee reported that villagers can claim individual use rights to sugar palms by marking them with a special sign. In all communities outsiders are not allowed to harvest sugar palm, paper mulberry and incense bark. Broom grass, on the other hand, is regarded in all villages as an open access resource, as it now grows nearly everywhere in short-fallow fields and along roadsides. This finding contrasts with an earlier study of Yokoyama [2004] who found that broom grass could only be gathered on individual swidden fields.



#### IV NTFP Value Chains: Paper Mulberry in Pha Oudom District, Bokeo Province

The successful domestication of paper mulberry (*Broussonetia papyrifera*) suggests that new opportunities are arising for developing sustainable agroforestry systems in northern Laos, particularly as farmers are under intense pressure to reduce their fallow periods. Paper mulberry is a particularly interesting perennial crop as it can be used for multiple purposes (soil improvement, weed suppression, animal feed, cash income from bark, fuel wood) and its production and management system is very flexible, making it suitable for a variety of socio-economic conditions [Aubertin 2004; Watanabe *et al.* 2004; Fahrney *et al.* 2007; Manythong 2008; Ogata *et al.* 2008; Saito *et al.* 2009].

##### IV. 1 *Characteristics of the Farm Households*

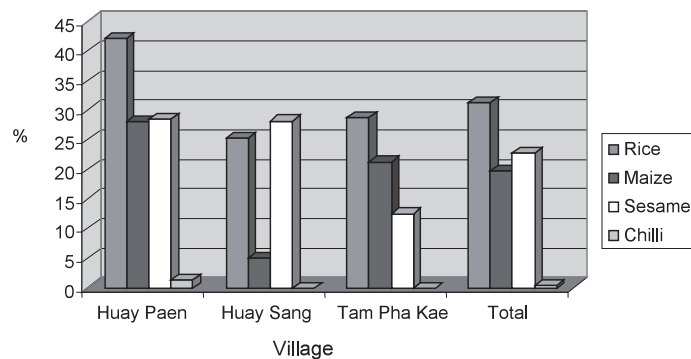
**Demography.** On average surveyed farm households can be characterized as a large family that consists of around eight people. Yet, ethnic differences are considerable. In Huay Paen (Lamet/Khmu) the medium family size is around five persons, while in Tam Pha Kae (Hmong) the family size is much larger, with about nine persons slightly higher than in Huay Sang (Khmu). About three family members work on the farm, and nearly all of them are involved in the paper mulberry production system (Table 3).

**Cropping systems.** Most farm households practice multiple cropping systems, with rice,

**Table 3** Demographic Characteristics of the Farm Households

| Variable  | Mean Number of Family Members |                       |                         |                   |
|---|-------------------------------|-----------------------|-------------------------|-------------------|
|   | Huay Paen<br>(n = 13)         | Huay Sang<br>(n = 16) | Tam Pha Kae<br>(n = 16) | Total<br>(n = 45) |
| Family size   |                               |                       |                         |                   |
| Total family members                                    | 5.5                           | 8.7                   | 9.2                     | 7.9               |
| Male  | 2.5                           | 4.8                   | 4.6                     | 4.2               |
| Female  | 2.9                           | 3.9                   | 4.6                     | 3.8               |
| Age structure   |                               |                       |                         |                   |
| under 10 years old                                      | 1.2                           | 3.1                   | 3.3                     | 2.6               |
| 10–60 years old   | 4.2                           | 5.3                   | 5.6                     | 5.1               |
| older than 60 years                                     | 0.1                           | 0.3                   | 0.3                     | 0.2               |
| Average number of family member<br>work on farm         | 2.8                           | 3.6                   | 3.4                     | 3.3               |
| Family members involved in paper<br>mulberry production |                               |                       |                         |                   |
| Male  | 0.8                           | 0.4                   | 1.1                     | 0.8               |
| Female  | 1.6                           | 1.8                   | 1.7                     | 1.7               |

Source: Authors' survey 2007



**Fig. 5** Contribution of Major Crops to Total Crop-based Cash Revenues

Source: Authors' survey 2007

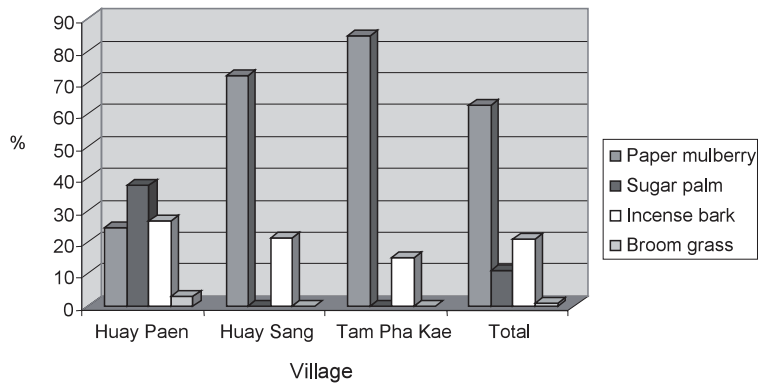
maize, chili and sesame being the most important crops. Maize, upland rice and chili are planted in June, while sesame is planted in July. The cropping systems in Huay Paen are more diversified than those in Huay Sang and Tam Pha Kae (Fig. 5). This is probably due to the fact that Huay Paen is located closer to the center of Pha Oudom district and therefore has better market access.

#### IV. 2 Socio-economics of NTFPs

**Contribution of NTFPs to the household economy.** The most important NTFPs in the study area include paper mulberry (*Broussonetia papyrifera*), sugar palm (*Arenga westerhoutii*), broom grass (*Thysanolaena latifolia*) and incense bark from *peauk meuak* (*Boehmeria malabarica*). Most households are involved in paper mulberry production especially in Tam Pha Kae and Huay Sang (Fig. 6).

**Farm and household economy.** The average family cash revenues from cropping and NTFPs for all households in the sample was 1,652,217 Kip in 2006/07. Households in Huay Paen generated the highest average cash revenues with 2,845,565 Kip, while Huay Sang had the lowest with only 793,725 Kip per year (Table 4). Considering the source of cash revenues, the village with the highest average cash revenues had the lowest contribution of paper mulberry cash revenues in total cash revenues. The correlation between cash crop revenues and paper mulberry revenues is negative which means that for poorer households paper mulberry provides a crucial supplementary source of cash revenues (Fig. 7).

As confirmed by other studies, poorer households collect significantly more plant-based NTFPs compared to more affluent households. In households with average plant-based cash revenues of less than 2 million Kip, NTFPs provided between 31.5% (in Huay Paen) and nearly 80% (in Tam Pha Kae) of the total plant-based cash revenues. This underscores the importance of NTFPs as a safety net for the poor and as a crucial



**Fig. 6** Contribution of Major NTFPs to Total NTFP Cash Revenues  
Source: Authors' survey 2007

**Table 4** Cash Revenues from Various Activities

| Cash revenues  | Huay Pean<br>(n = 13) | Huay Sang<br>(n = 16) | Tham Pha Kae<br>(n = 16) | Total<br>(n = 45) |
|--|-----------------------|-----------------------|--------------------------|-------------------|
| Revenues from cash crops<br>(Kip/year)                   | 2,845,565             | 793,725               | 1,541,113                | 1,652,217         |
| Cash revenues from NTFPs<br>(Kip/year)                   | 478,215               | 141,188               | 249,550                  | 277,080           |
| Cash revenues from paper mulberry<br>(Kip/year)          | 79,523                | 104,063               | 197,675                  | 130,258           |
| Contribution of paper mulberry to<br>total cash revenues | 2.8                   | 13.1                  | 12.8                     | 7.8               |

Source: Authors' survey 2007

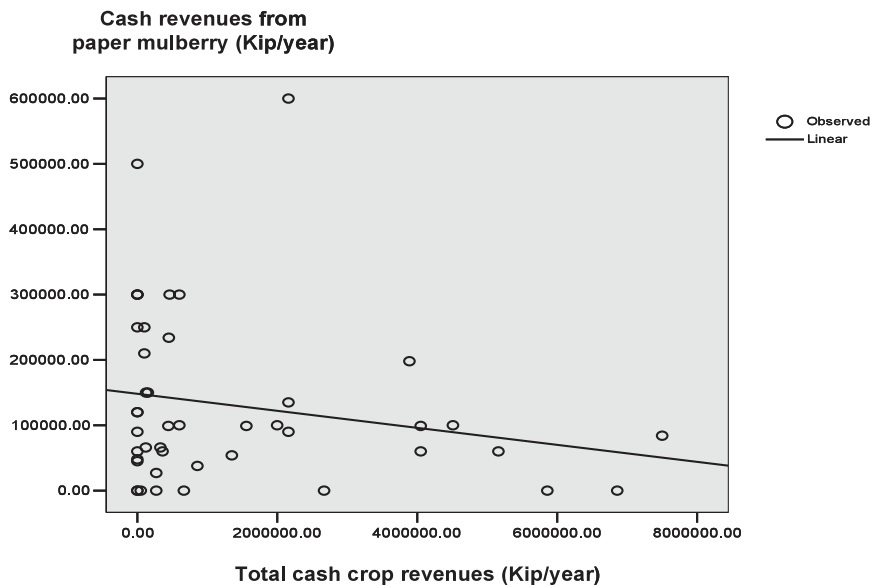
provider of cash revenues during food insecure periods. Families endowed with enough agricultural land can derive relatively high cash revenues from crop production and rely much less on NTFPs including paper mulberry production and harvesting.

We also found a positive correlation between the number of female family members and family cash revenues from paper mulberry (data not shown) which implies that paper mulberry is predominantly an income opportunity for women.

#### IV. 3 *Production and Collection Systems of Paper Mulberry*

##### IV. 3. 1 *Production*

In northern Laos, ethnic minority groups have collected paper mulberry bark from the forests surrounding their villages for decades. Paper mulberry prefers moist alluvial soils [Aubertin 2004; Fahrney *et al.* 2007; Saito *et al.* 2009]. River and stream valleys or lowland moist areas are the best places for this perennial plant to grow. However, due to population pressure, decline of forest resources and over-harvesting, today villagers have



**Fig. 7** Relationship between Revenues from Paper Mulberry and Total Cash Crop Revenues

Source: Authors' survey 2007

**Table 5** Contribution of Cash Revenues Classified by Source and Wealth Class of Farmers

| Wealth Class of Farmers<br>by Total Plant-based Cash<br>Revenues (Kip) | Huay Paen<br>(n = 13) |      | Huay Sang<br>(n = 16) |      | Tam Pha Kae<br>(n = 16) |      |
|--|-----------------------|------|-----------------------|------|-------------------------|------|
|  | Cash crops            | NFTP | Cash crops            | NFTP | Cash crops              | NFTP |
| < 2,000,000  | 68.5                  | 31.5 | 39.4                  | 60.6 | 20.8                    | 79.2 |
| 2,000,000–4,000,000  | 91.5                  | 8.5  | 96.0                  | 4.0  | 86.2                    | 13.8 |
| > 4,000,000  | 87.2                  | 12.8 | 97.2                  | 2.8  | 98.3                    | 1.7  |

Source: Authors' survey 2007

to spend more time and labor to collect the same amount of bark as before. In addition, the product collected from the forest is often of inferior quality since villagers harvest whatever bark of paper mulberry trees they can find because of competition with other collectors and the lack of management and harvesting regulations. As a result, some farmers have started to grow paper mulberry in their home gardens, upland rice fields and fallows [Fahrney *et al.* 2007]. Growth rates on the upland fields are considered lower than in lowland areas where it is possible to reap the first harvest 6–8 months after planting the trees. In contrast, in the upland fields farmers may need to wait 10–12 months for the first harvest.

Forsen *et al.* [2001] reports that in the Lao PDR paper mulberry is grown in three different ways, namely in natural stands, cultivated stands and inter-cropping systems.

Paper mulberry bark harvested from natural stands is considered as a NTFP and mainly found in secondary hillside forest. The determination of the source of the bark is important since traders who want to export bark that is classified as NTFPs need to obtain a quota from the government and pay a 'natural resource tax.' Paper mulberry bark that stems from cultivated stands is exempted from the quota and tax system. Yet, we could not find out how tax collectors would determine — or how traders can provide evidence — whether mulberry bark comes from cultivated or natural stands.

Harvesting from natural stands does not require any capital investment and little labor input in terms of management such as planting and pruning. However, since the price for paper mulberry bark increased and more people have begun to collect the bark in Pha Oudom district, it is becoming harder to find natural stands of paper mulberry. This can be described as the problem of an open access resource that becomes degraded (see Chapter III. 2). Another disadvantage with collecting bark from natural stands is that the yield is often low and the quality is poor compared to bark harvested from plantations.

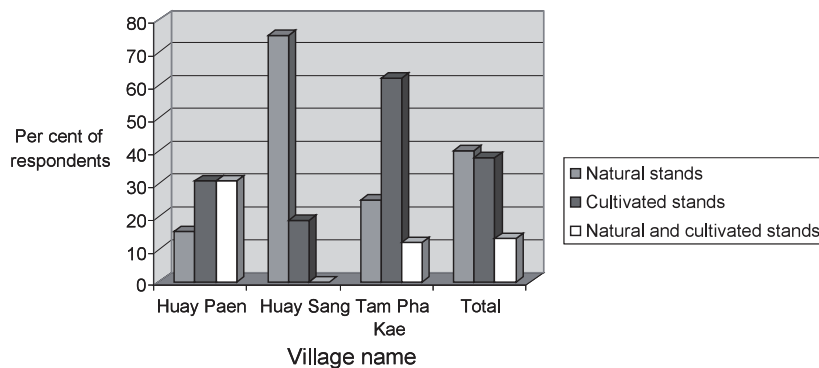
As paper mulberry is among the NTFPs that can be easily domesticated, more land-rich farmers in Pha Oudom district have started to cultivate paper mulberry in their fields. The most entrepreneurial villagers have even set up small nurseries, partly supported by external development assistance (see example in Box 1). Some farmers are growing paper mulberry trees on upland rice fields. This system can be considered as inter-cropping: in their upland rice field, farmers would plant rice in the second half of May and then transplant paper mulberry seedlings in July. In some rice fields young shoots and seedlings of paper mulberry grow from roots and seeds from the previous generation that was cut and burned before planting rice; in this case farmers just keep the shoots and seedlings and add more seedlings into the field if needed.

The GTZ-funded project RDMA Bokeo supported the establishment of a private NTFP and fruit tree nursery in Huay Paen, a village with Lamet and Khmu population. The village does not have any wet-rice area, but the upland agricultural area is relatively large and during the land use planning process big areas of conservation, protection and production forests have been delineated. Mr. Kammanh, the manager of the NTFP and fruit tree nursery, is the village's vice-headman and member of the village committee, responsible for land use planning. He obtained a credit from the Village Development Fund (VDF) of 4,000 Baht and contributed his own budget of 3,000 Baht. Last year he sold 1,500 seedlings of paper mulberry, 1,500 seedlings of *peuak muak* (for production of incense bark), 400–500 seedlings of agarwood and around 275 seedlings of mango and jackfruit to farmers from Huay Paen and neighbouring villages. His net benefit after paying back his loan to the VDF was around 3 million Kip (ca. 10,700 Baht or 330 US-\$) in 2007.

Despite his success he will reduce the area of the nursery this year from 3,500 m<sup>2</sup> to 700 m<sup>2</sup>. He stated that he lacks the labour force to manage such a big nursery. He will grow rubber on one of his two upland plots next year, along with 15 other farmers in his village, and needs to invest a lot of labour into this new activity.

**Box 1** Successful Domestication of NTFPs: The case of Mr. Kammanh in Huay Paen Village, Pha Oudom District, Bokeo Province

Source: Own survey, February 2008



**Fig. 8** Types of Paper Mulberry Production Systems

The example in Box 1 shows how external project support in Pha Oudom helped to establish a village nursery for various NTFPs. Yet, it also shows the challenges that such initiatives face with the current expansion of rubber plantations.

Hmong farmers in Tam Pha Kae appear to be particularly keen on securing cash income from mulberry bark production and benefitting from the various other by-products of paper mulberry trees. The majority of the respondents in this village stated that they have established paper mulberry plantations in recent years (Fig. 8). Some farmers reported they have been growing paper mulberry on more than 1 hectare and harvest around 500 kg per season.

In sum, the particular appeal of paper mulberry cultivation is that the crop requires relatively little management and that farmers can use it very flexibly, i.e. they can adjust plant densities, growing periods, harvesting times and plant parts used according to their specific needs [Aubertin 2004; Fahrney *et al.* 2007].

#### IV. 3.2 *Harvesting and Post-harvest Handling*

Within one day a farmer can collect between 10 and 30 kg of fresh bark. Farmers harvested bark from whatever paper mulberry trees they found, which usually are old trees (two to three years old). Farmers reported that they had been informed by local traders to collect primarily the bark from young trees (around one year of age) and to separate the bark from the young and old trees to obtain different grades and prices. Yet, most of the respondents collected the bark from older trees to get more weight per unit of labor. Usually, the collectors mix the bark of different qualities and sell it to the trader as one grade, which then yields the lowest price (referred to as grade C). Most of the farmers harvest the bark from the main stems, only occasionally bark is collected also from the branches. Debarked stems and branches are left to dry and then used for fuelwood if the harvesting areas are not too distant from the residential area.

When paper mulberry bark is harvested, the stems of the trees are cut about 40

centimeters above the ground. The bark is pulled from the stems and occasionally from the branches. Then farmers carry the bark back to the village where they have to strip the outer bark off as soon as possible; otherwise it would be very difficult to peel once the bark becomes dry. After peeling, the inner bark would be dried for two to three hours and kept in a dry place until the local trader arrives.

Some studies report that harvesting of paper mulberry bark is done all year round, while others suggest two main periods, namely late February to the beginning of April and September to October [Forsen *et al.* 2001; Fahrney *et al.* 2007; Saito *et al.* 2009]. However, from our study site, farmers harvested only from February to April due to available labor in a time where they do not need to work in the rice fields or are occupied with other agricultural activities. In addition, respondents indicated that this time — the hot dry season — is very suitable for debarking and drying the bark.

A village trader in Tam Pha Kae (Hmong) reported that including bark from natural stands and cultivated stands, he collected more than 2 tons a year from the villagers. He also indicated that on average a family in this community got a harvest of around 100 kg



1



3



2



4

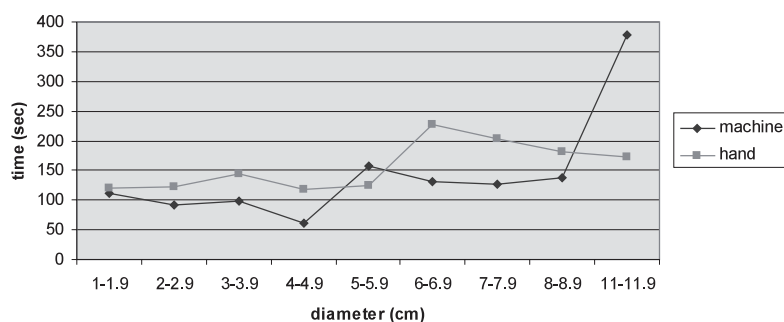
**Photos 1–4** Debarking Paper Mulberry Stems (Photo 1), Carrying the Fresh Bark from the Field to the Homestead (Photo 2), Stripping the Inner Bark (Photo 3), and Sun-drying the Cleaned Inner Bark (Photo 4).

of dry bark annually. By contrast, in Huay Paen village (Lamet and Khmu) the average harvested bark per family was reported to be only 50 kg per year.

In order to assess the time spent for post-harvest handling and determine the weight loss, we recorded the entire process in several occasions. We found that the farmers spent one hour for peeling 5 kg of the bark. On average, one farmer got 15 kg of the bark so they spent three hours in the afternoon for peeling all the bark. After the peeling process, farmers would sun-dry the inner bark for 2–3 hours. During the process — from the fresh bark to the dry inner bark — around 40% of fresh weight was lost. Hence, in one day, the farmers got 9 kg of dry inner bark from 15 kg of the fresh bark, indicating a conversion ratio of fresh bark to peeled and dried bark of 0.6.

From an average of 15 kg of fresh bark collected in one day, 9 kg of dried inner bark can be obtained after labor-intensive, manual cleaning and sun-drying. The price for 1 kg of dried bark was around 2,700 Kip in 2007, which implies a total gross margin of 24,300 Kip (2.43 US-\$) per day. When the opportunity costs of time for the farmers are calculated at 1 US-\$ per day, the net profit of 1.43 US-\$ per day appears attractive, particularly as the harvesting period of paper mulberry is flexible and does not compete with agricultural activities.

Since stripping of the inner bark is a time-consuming activity, the RDMA project in cooperation with the Uplands Program tested the efficiency and economic viability of machine-stripping of the inner bark in comparison with manual stripping. Fig. 9 shows that the machine — a prototype developed by Kasetsart University in Bangkok, Thailand — is mostly superior to manual cleaning in terms of time needed, except for two ranges of diameter (5–5.9 and 11–11.9). The machine has been successfully used by an innovative farmer in Huay Paen who stated that farmers in neighbouring villages have expressed their strong interest in using the machine. Yet, before promoting the use of machines on a wider scale, the gender impact needs to receive attention since manual stripping is traditionally women's work and machine-stripping tends to be done by men



**Fig. 9** Time Requirement of Manual vs. Machine Stripping of Inner Bark of Paper Mulberry

Source: Authors' experiment 2007





**Photo 5** Khmu Woman Stripping the Inner Bark of Paper Mulberry



**Photo 6** Testing the Labour Requirement and Economic Viability of Machine Stripping

(Photos 5 and 6).

#### IV. 4 *Commercialization of Paper Mulberry Bark*

Paper mulberry has been harvested and processed into paper in Laos for many decades. In earlier times, for example, mulberry paper was used for wrapping opium. Recently new markets have opened up through tourism and exports [Forsen *et al.* 2001]. In a first step, the dried inner bark is further processed into pulp which is the main material for producing paper. This type of paper (commonly known as *saa* paper in Lao PDR and Thailand) is used for making a variety of products, such as boxes, envelopes, picture frames, paper strings, lamps, and umbrellas. Yet, none of the respondents in our sample in Pha Oudom district processes either pulp or paper. Only 4.4 % of the respondents knew that the final product of their bark is paper.

##### IV. 4.1 *Marketing channels in Lao PDR*

The inner bark is marketed by three types of traders: village collectors, district collectors and provincial traders. Each trader plays a different role in the marketing channel and offers various services in the value chain, such as transport, credit and storage.

**Village collectors.** The village collector buys the bark and/or other cash crops from the farmer in the village and from the nearby village. In the study area there are 1-2 village collectors in each village and they pay the farmers in cash. There is usually a farmer in the village who acts as the village collector. The village collector will mainly transport the bark to district traders in Pha Oudom.

**District traders.** The district traders buy cash crops from the village collectors or directly from farmers, store them and then transport them to provincial traders, for example in Bokeo province or in Luang Prabang province. Selling to the provincial trader in Bokeo province is the preferred destination, as the trader would get lower profit

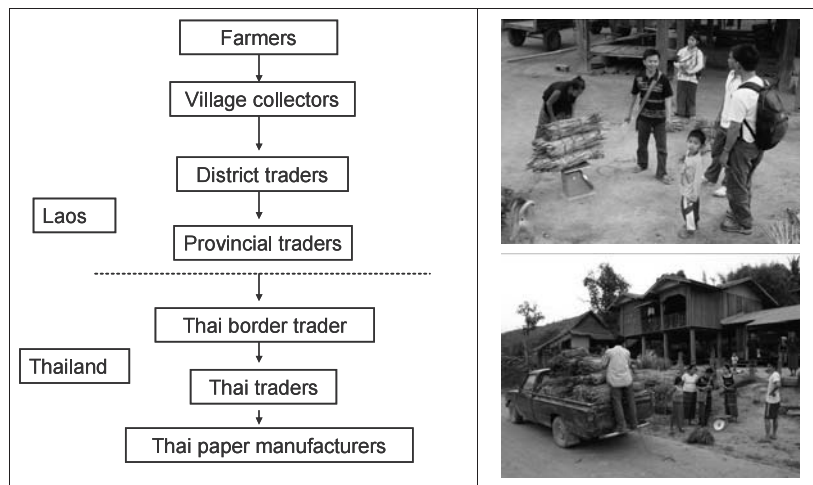
from selling in Luang Prabang owing to the higher transportation costs. Moreover, Luang Prabang provincial traders prefer to buy the bark in a compressed form in order to be able to take a larger quantity. The provincial traders would give only one grade for the entire bark in the truck and then offers the price related to the estimated grade. The main reason for not exporting the bark directly to Thailand indicated by district traders was that they fear the complexity of the export process and the high export expenses, including shipping cost by boat and customs tariffs. The costs and net profits of farmers, village collectors and district traders are shown in Table 6.

Yet, village collectors do not operate in every village, many district traders collect the dried bark directly from individual farmers or farmers may bring their produce to the district trader with their own means of transportation (e.g. on foot). Hence, the entire marketing chain within Laos is characterized by a simple, linear structure with various profit-taking stages (Fig. 10).

**Table 6** Costs and Profits of Different Actors in the Value Chain (per kg of dried bark)

| Item                 | Farmer | Village Collector | District Trader |
|----------------------|--------|-------------------|-----------------|
| Price (Kip)          | 2,700  | 3,000             | 4,465           |
| Gross margin         | 2,700  | 300               | 1,465           |
| Opportunity costs    | 1,100  | —                 | —               |
| Transportation costs | —      | 72                | 500             |
| Taxes and duty       | —      | —                 | 400             |
| Net profit           | 1,600  | 228               | 565             |

Source: Authors' survey 2007



**Fig. 10** Linear Marketing Channels for Paper Mulberry in Laos and the Main Importing Country Thailand

**Provincial traders.** The bark from Pha Oudom is mainly sold to two provincial traders without any quota. The traders would buy all the bark from Pha Oudom which shows the potential of increasing paper mulberry production. The trader transports the bark to a border point in Huay Xai. The bark is transported by boat to the border traders in Chiang Khong in Chiang Rai province, northern Thailand. The freight-space of the boat ranges from 5–30 tonnes, depending on the vessel. The bark is sold in a pre-graded form to Thai traders. Most of the time the payment is done in cash, but during the period of oversupply the provincial trader has to give Thai buyers a credit for up to one month [Forsen *et al.* 2001]. The average purchasing price of the provincial trader at the beginning of 2007 was 14–19 baht per kg depending on the grade.

#### IV. 4. 2 *The Thai Part of the Supply Chain*

The total national consumption of paper mulberry bark in Lao PDR is estimated at not more than 100 tonnes per year [Helberg 2005], while most of the bark harvested by the estimated 27,000 Lao bark collectors is destined for export to Thailand. The final grading of the dried bark is also done in Thailand which effectively blocks imports of processed mulberry bark (e.g. in the form of pulp or paper sheets) through a high import tariff system. In the entire commercialization process of paper mulberry, Thailand turns an imported raw material worth less than 1 million US-\$ annually into paper products worth around 50 million US-\$ [Midgley *et al.* 2007].

**Thai border traders.** Forsen *et al.* [2001] reported that there are many different border traders buying cash crops from local traders in Laos and selling them to manufacturing companies in Thailand. Some Thai border traders buy ungraded bark and grade it themselves. The lack of storage facilities is a major problem for Thai border traders forcing them to sell it to Thai paper manufactory without being able to stock-pile it in times of oversupply and lower prices.

The information transfer between the bark's origin and the end market of the bark can be classified as insufficient and non-transparent. Thai border traders do not know the origin of the bark from Laos, while Lao farmers do not know the final users of the dried bark and which types of products the bark will be processed into.

**Trade flows at the Thai-Lao border.** According to the report of the Customs Office at the Thai-Lao border in Chiang Rai and Loei provinces, the import quantity of paper mulberry bark from Laos has fluctuated since 2002 due to the instability of Thai domestic supply and demand for imported paper mulberry bark and the variability of supply in Laos (Table 7).

**Manufacturers in Thailand.** Paper mulberry bark has been used in Thailand as raw material for handmade paper for a long time, especially in the northern part. Traditionally the paper has been used for Buddhist scripts, temple decorations at festival times, umbrellas, fans and kite making. In former times it was also used as a filter in the manufacture of lacquer ware. Farmers also used to make strings and ropes from

**Table 7** Quantity and Value of Paper Mulberry Shipped from Laos to Thailand at the Chiang Khong Border from 2002–06

| Year | Quantity (in tonnes) | Value (Baht) |
|------|----------------------|--------------|
| 2002 | 181                  | 1,457,492    |
| 2003 | 471                  | 3,298,000    |
| 2004 | 733                  | 5,133,806    |
| 2005 | 470                  | 3,331,351    |
| 2006 | 208                  | 1,455,127    |

Source: Authors' survey 2007; data from Chiang Khong border office 2006

mulberry fibers prior to the introduction of substitute materials, such as sisal and nylon [Aubertin 2004]. Today it is used for a wide variety of domestic and industrial purposes, including paper towels in hospitals, wrapping and gift paper, wallpaper, lampshades, bookmarks, picture-frames and greetings cards.

The largest processing factory with an annual capacity of 1,500

tonnes of bark is located in Sukhothai province [Fahrney *et al.* 2007]. Paper mulberry bark in Thailand is produced both with machines and by hand. Approximately 55 % of the paper is processed with machines and the rest by hand [Forsen *et al.* 2001].

**Exports from Thailand to other countries.** While low-quality paper is processed into domestic paper products, high-grade mulberry bark and processed mulberry paper from Thailand is exported primarily to Japan and South Korea. The highest quality — super A — is exported without further processing to Japan where the bark is reportedly processed into special paper for banknotes, liturgical objects, lanterns and luxury stationery [Aubertin 2004; Fahrney *et al.* 2007]. Demand in South Korea appears to be similarly fluctuating as domestic demand in Thailand: according to Kang and Kohroki [2008] imports of paper mulberry increased from 88,000 tonnes in 2003 to 143,000 tonnes in 2005 and then dropped sharply to 67,000 tonnes in 2006.

#### IV. 5 *Impact of Government Policies and Land Use Change on the Future of Paper Mulberry Production Systems*

According to Aubertin [2004] the Lao government has not shown much interest in paper mulberry production. She reports that the plant neither was included in the national agricultural census of 1998/99 nor did it appear in the list of plants for which the Ministry of Agriculture issued production forecasts for the 1999/2000 harvest. This lack of interest contrasts sharply with the great deal of local innovation as regards paper mulberry domestication and farmers' experimentation with a variety of mixed cropping systems based on paper mulberry which appears to have not been actively supported by the District Agricultural and Forestry Offices in northern Laos.

The legal framework that may affect the further development of paper mulberry production —and other NTFPs— has been described as fragmentary and inconsistent [Rigg 2005; Ribeiro and Darnhofer 2007]. The Lao Forest Law differentiates between customary use of NTFPs for subsistence purposes and the commercial use of NTFPs, the latter being regulated by quotas and taxes [GoL 1996; Helberg 2005; Ribeiro and Darnhofer 2007]. While groups with long-standing forest use rights are entitled to collect

NTFPs and firewood in production forests, they can only do so without causing damage to the forest — which is open to varying interpretations [cf. Rigg 2006]. Frequent resettlements also contribute to insecurity of land use and prevent villagers from developing sustainable management systems for NTFPs.

The Land and Forest Allocation policy is driven by the government's goal to eradicate shifting cultivation and to stabilize agriculture. In sloping land, farm households can only receive up to three plots, which reduces the fallow period to a maximum of two years. Permanent land titles — LTD 01 or *bai ta din* — are allocated by the District Land Office (DLO) for permanent types of land uses, such as housing land, home gardens, paddy land and tree plantations. In rare cases such LTD 01 would also be issued for paper mulberry plantations, as stated by one DAFO officer in Sienghone district (Sayabouri), but this could not be verified in the surveyed villages in Pha Oudom district (Bokeo) where the land allocation process has been marked by particularly strong legal ambiguities and severe land use conflicts between and within local communities. Secure land use titles are definitely not issued for long-term land use on the basis of annual crops, and it is unclear whether they are issued for agroforestry systems, e.g. paper mulberry or teak trees intercropped with upland rice. One officer of the DLO in Meung district (Bokeo province) stated that the Land Law of 2005 does not clearly indicate whether combinations of annual crops and perennial crops or trees would classify as permanent land use systems. Hence, while paper mulberry plantations in mono-culture do not appear to be sufficiently supported by the official tenure policy, the more flexible integration of paper mulberry trees in multiple cropping systems seems to be even more bypassed and undermined by current government policies.

The natural occurrence of paper mulberry in Pha Oudom district appears to be particularly doomed if current trends of land use change from swidden farming to rubber monoculture continue. Rubber plantations promoted by foreign investors and the Lao government alike have not only reduced the area of production forests and swidden agriculture, but are also increasingly entering into paddy fields and protection and conservation forests. In this process, thousands of land-poor ethnic minority villagers are gradually losing a significant source of income and a crucial buffer against seasonal food and cash shortages.

## V Conclusions: Potential and Constraints of Developing Paper Mulberry Value Chains in Support of Sustainable Rural Livelihoods

While Foppes and Ketpanh [2000: 15] expressed optimism that “Lao PDR has a remarkable opportunity to build a strong NTFP sub-sector as a basis for sustainable economic development in the Southeast Asian region, Rigg [2006: 128] holds that “the best outcome in the medium term is that NTFPs will become a niche livelihood activity undertaken by

the few, rather than the many". With regard to naturally occurring paper mulberry the position taken by Rigg seems to be the more likely scenario. Collection from natural stands will decline with negative implications for the poor and landless — and for ethnic minority women in particular, while more management-intensive systems and monocultures of paper mulberry may expand in the medium term, with potentially negative consequences for biodiversity. Whether paper mulberry can become a profitable component of sustainable agroforestry systems depends strongly on the willingness of the Lao government to support more diversified upland production systems rather than promoting rubber and other tree plantations as the single model for resource-based poverty alleviation in northern Laos. Recent studies have amassed sufficient evidence that agronomic performance and economic productivity of properly managed paper mulberry — upland rice rotations can be superior to traditional swidden systems [Watanabe *et al.* 2004; Fahrney *et al.* 2007; Saito *et al.* 2009].

The value-chain analysis for paper mulberry conducted in Pha Oudom has confirmed the typical weaknesses of the NTFP sector in northern Lao PDR; village-based processing of paper mulberry is limited to very early stages of the value chain (stripping the inner bark, cleaning, drying). There are currently few attempts by villagers to improve the quality of paper mulberry bark, although the trend towards bark collection from cultivated stands is likely to indirectly contribute to quality improvement. To date, villagers do not actively seek for marketing channels and due to the absence of producer or marketing cooperatives trade conditions and market prices cannot be negotiated, but are set by other actors, such as district and provincial traders and — in particular — by Thai importers. Lessons learned from various internationally funded projects in northern Lao PDR suggest that NTFP marketing groups can be successfully established with sufficient external support [e.g. Ingles *et al.* 2006]. Yet, there is no sufficient evidence that such marketing groups are viable beyond the project duration and whether such initiatives are taken up spontaneously in neighbouring villages.

Although overall demand for high-quality paper mulberry bark appears to remain strong, the nearly entire dependency on export markets (directly from Thailand and indirectly from demand in South Korea and Japan) makes paper mulberry production systems vulnerable to changes in foreign demand and the introduction of alternative fibres. To conclude, the future of paper mulberry value chains and their contribution to rural livelihoods depends on a variety of domestic and external factors, but above all on the political will of national decision-makers to rethink their controversial agricultural, forest and rural development policies.

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